

Listing of the Claims:

1. (Currently Amended) A motor vehicle all wheel drive system for automatically providing maximum traction and efficiency without wheel slip, with regeneration and retardation for each individual wheel of the vehicle under all loading and driving conditions regardless of driving surface, characterized in that:

the system includes a device for generating energy, a drive motor for each wheel receiving energy from the generating device, [and] means at each wheel operative to sense a loss of wheel traction[.], and means operative in response to a sensed loss of traction at a wheel to modify the output of the generating device in a sense to reduce the torque of the motor driving that wheel to match the traction of the wheel.

2. (Currently Amended) A motor vehicle all wheel drive system according to claim 1 wherein:

~~the system further includes a device for generating energy;~~
~~each motor receives energy from the generating device and drives a wheel of the vehicle;~~

the system further includes an energy storage device and a device for directing energy flow in the system; and

the means at each wheel operative to sense a loss of traction comprises means for sensing wheel load and operative;

in response to sensed wheel load to direct energy from the energy generating device to the motor;

in response to a sensed loss of wheel load to reduce the energy supply to the motor and direct the motor energy discharge to the energy storage device; and

in response to a sensed resumption of wheel load to direct regenerative energy from the energy storage device to the motor to assist in powering the motor.

3. (Original) A motor vehicle all wheel drive system according to claim 2 wherein each motor is further operative to provide forward and reverse propulsion.

Please cancel claim 4 and re-write it in independent form as new claim 21.

5. (Original) A motor vehicle all wheel drive system according to claim 3 wherein:

the energy provided to each motor is proportioned to the setting of an acceleration control device for the vehicle; and

the energy provided to each motor is varied in proportion to the turning radius of the wheel powered by that motor when making a turn.

Please cancel claim 6 and rewrite it in independent form as new claim 22.

Please cancel claim 7 and rewrite it in independent form as new claim 23.

8. (Currently Amended) A motor vehicle all wheel drive system according to claim [7]23 wherein the energy directing device includes a first valving device controlled by a vehicle shifting mechanism and operative to shift the fluid flow to the hydraulic motor between forward and reverse mode.

9. (Currently Amended) A motor vehicle all wheel drive system according to claim [7]23 wherein:

the system includes a tank; and

the energy directing device further includes a second valving device coupled to the first valving device and operative to direct the flow of pressurized

fluid from the accumulator to the motor only when the first valving device is in forward mode and the fluid discharge is to tank.

10. (Currently Amended) A motor vehicle all wheel drive system according to claim [7]23 wherein:

each pump includes a yoke which is pinned at diametrically opposite ends with the yoke ends free to rotate about the pin connections;

one pinned end of the yoke is the center of a ball which is internally threaded and which is free to rotate relative to the yoke;

an adjusting screw is threadably received in the ball whereby rotation of the screw effects selective pivotal movement of the yoke; and

the other end of the yoke is connected to a lightly spring loaded piston subjected on one face to pump output pressure by way of an internal passage and subjected on an opposite face to motor input pressure by way of an external connection.

11. (Original) A motor vehicle all wheel drive system according to claim 10 wherein:

the rotational rate of the axial piston pump is varied in response to variations in the RPM of the vehicle engine;

each axial piston pump includes an electric motor driving the adjusting screw; and

the system further includes an electric motor modulating means operative in response to sensed variations in the vehicle steering angle to actuate the adjusting screw and thereby vary the flow rate of the associated axial piston pump.

12. (Currently Amended) A motor vehicle all wheel drive system according to claim [6]22 wherein:

the energy storage device comprises an accumulator;

the system further includes a tank; and

fluid pressure from brake actuation is operative to divert motor discharge from the tank to the accumulator.

13. - 17. (Withdrawn).

18. (Currently Amended) A motor vehicle all wheel drive system including a device for generating energy, a motor receiving energy from the generating device and driving a wheel of the motor vehicle, an energy storage device for receiving energy discharge from the motor, and a directional device for directing energy flow in the system, characterized in that:

the system includes means for sensing wheel [load]motor torque; and
the directional device is operative in response to sensed wheel [load]motor torque to direct energy from the energy generating device to the motor and is operative in response to a sensed loss of wheel [load]motor torque to direct the motor energy discharge to the energy storage device.

19. (Currently Amended) A motor vehicle all wheel drive system according to claim 20 wherein:

the sensing system is operative in response to a sensed resumption of wheel [load]motor torque to direct regenerative energy from the energy storage device to the motor to assist in powering the motor.

20. (Currently Amended) A motor vehicle all wheel drive system comprising:

a generating device for [generating]supplying energy at a defined flow rate and a defined intensity;

a motor at each wheel of the motor vehicle receiving energy from the generating device and driving [a]the respective wheel of the motor vehicle;

means for sensing ~~wheel load~~ the intensity of the energy arriving at each motor; and

means operative in response to a sensed loss of ~~wheel load~~ energy intensity at a motor driving a particular wheel, indicative of a loss of traction at that wheel, to reduce the intensity of the energy supply to [the]~~that~~ motor from the generating device to a level matching the traction requirement of that ~~wheel load~~ requirements.

21. (New) A motor vehicle all wheel drive system for automatically providing maximum traction and efficiency without wheel slip, with regeneration and retardation for each individual wheel of the vehicle under all loading and driving conditions regardless of driving surface, characterized in that:

the system includes a drive motor for each wheel and means at each wheel operative to sense a loss of traction;

the system further includes a device for generating energy;

each motor receives energy from the generating device and drives a wheel of the vehicle;

the system further includes an energy storage device and a device for directing energy flow in the system;

the means at each wheel operative to sense a loss of traction comprises means for sensing wheel load and operative;

in response to sensed wheel load to direct energy from the energy generating device to the motor;

in response to a sensed loss of wheel load to reduce the energy supply to the motor and direct the motor energy discharged to the energy storage device; and

in response to a sensed resumption of wheel load to direct regenerative energy from the energy storage device to the motor to assist in powering the motor;

each motor is further operative to provide forward and reverse propulsion; and

the energy from the generating device is utilized to provide forward and reverse motor drive and the stored energy from the energy storage device is utilized to provide only forward motor drive only when the motor is directed to a forward drive mode and the motor is no longer overrunning.

22. (New) A motor vehicle all wheel drive system for automatically providing maximum traction and efficiency without wheel slip, with regeneration and retardation for each individual wheel of the vehicle under all loading and driving conditions regardless of driving surface, characterized in that:

the system includes a drive motor for each wheel and means at each wheel operative to sense a loss of traction;

the system further includes a device for generating energy;

each motor receives energy from the generating device and drives a wheel of the vehicle;

the system further includes an energy storage device and a device for directing energy flow in the system;

the means at each wheel operative to sense a loss of traction comprises means for sensing wheel load and operative;

in response to sensed wheel load to direct energy from the energy generating device to the motor;

in response to a sensed loss of wheel load to reduce the energy supply to the motor and direct the motor energy discharged to the energy storage device; and

in response to a sensed resumption of wheel load to direct regenerative energy from the energy storage device to the motor to assist in powering the motor;

each motor is further operative to provide forward and reverse propulsion;

the system further includes a brake actuated means for each motor operative to divert the output of the motor to the energy storage device and thereby retard the rotation of the motor.

23. (New) A motor vehicle all wheel drive system for automatically providing maximum traction and efficiency without wheel slip, with regeneration and retardation for each individual wheel of the vehicle under all loading and driving conditions regardless of driving surface, characterized in that:

the system includes a drive motor for each wheel and means at each wheel operative to sense a loss of traction;

the system further includes a device for generating energy comprising an engine driven axial piston pump providing fluid pressure and fluid rate independent of each other;

each motor receives energy from the generating device and drives a wheel of the vehicle;

the system further includes an energy storage device and a device for directing energy flow in the system;

the means at each wheel operative to sense a loss of traction comprises means for sensing wheel load and operative;

in response to sensed wheel load to direct energy from the energy generating device to the motor;

in response to a sensed loss of wheel load to reduce the energy supply to the motor and direct the motor energy discharged to the energy storage device; and

in response to a sensed resumption of wheel load to direct regenerative energy from the energy storage device to the motor to assist in powering the motor;

each motor comprising a balanced vane type hydraulic motor defining two separate chambers wherein generated pressurized fluid from the generating

device is delivered to one chamber of each motor and stored pressurized fluid from the energy storage device is delivered to the other chamber of the motor;

loss of traction is sensed by a drop in system back pressure; and

the energy storage device comprises an accumulator for storing pressurized fluid.

24. (New) A motor vehicle all wheel drive system according to claim 20 wherein:

the generating device comprises a plurality of hydraulic pumps supplying pressurized fluid at a defined flow rate and a defined pressure to the respective motors driving the respective wheels;

the sensing means comprises means sensing the pressure of the fluid arriving at each motor; and

the operative means comprises means reducing the output pressure of a respective pump in response to a sensed loss of fluid pressure at the motor supplied by that pump.

25. (New) A motor vehicle all wheel drive system according to claim 1 wherein:

each drive motor comprises a hydraulic motor;

the means at each wheel operative to sense a loss of wheel traction comprises means operative to sense a loss of fluid inlet pressure to the drive motor for that wheel; and

the means operative in response to a sensed loss of traction at a wheel comprises means operative to reduce the fluid output pressure of the generating device and thereby reduce the motor torque to match the loss of traction.